RF TEST REPORT

Report: FCC_IC RF_ SL15112001-BBE-004A1_Rev 1.0

Supersedes: FCC_IC RF_ SL15112001-BBE-004A1

Applicant: B+B SmartWorx, Inc.

Product name: MESH RF IoT Module(s)

Model: 505-10368-00

Test standard: FCC 15.209; 15.247(d); IC RSS 247

Test method: ANSI C63.10 – 2013, 558074 D01 DTS Meas Guidance V03r04

FCC ID: F4AWSM2400

IC ID: 3913A-WSM2400

Date of test: 12/02/2015

Issue date: 01/08/2016

Test result: PASS

Equipment complied with the specifications: ☒

Equipment did not comply with the specifications: ☐

This test report is issued under the authority of:

Gary Chou

N. Molaei G.

Full Name: Gary Chou
Title: Test Engineer

Full Name: Nima Molaei
Title: Engineer Reviewer

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Test result presented in this test report is applicable to the tested sample only.

ISSUED BY:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, CA 95035 USA

ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for conformity assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for conformity assessment

Country/Region	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1. Report revision history

Report No.	Report Version	Description	Issue Date
FCC_IC_SL15112001-BBE-004A1	Original	None	01/08/2016
FCC_IC_SL15112001-BBE-004A1_Rev 1.0	Rev 1.0	Correct antenna gain and Power setting	06/06/2016

2. Executive summary

The purpose of this test program was to demonstrate compliance of following product:

Company: B+B SmartWorx, Inc.
Product: MESH RF IoT Module(s)
Model: 505-10368-00

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3. Customer information

Applicant name: B+B SmartWorx, Inc.
Applicant address: 707 Dayton Rd, Ottawa, IL 61350
Manufacturer name: B+B SmartWorx, Inc.
Manufacturer address: 707 DAYTON RD, OTTAWA, IL 61350

4. Test site information

Lab performing tests: SIEMIC Laboratories
Lab address: 775 Montague Expressway, Milpitas, CA 95035
FCC test site no.: 881796
IC test site no.: 4842D-2
VCCI test site no.: A0133

5. Modification

Index	Item	Description	Note

6. EUT Information

6.1. EUT Description

Product Name	MESH RF IoT Module(s)
Model No.	505-10368-00
Trade Name	B+B SmartWorx, Inc.
Serial No.	N/A
Input Power	3.3 VDC
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Date of EUT received	11/29/2015
Equipment Class/ Category	DTS
Port/Connectors	DC Input
Product Hardware Version	440-045 Rev2
Product Software Version	N/A
Radio Hardware Version	N/A
Radio Software Version	N/A

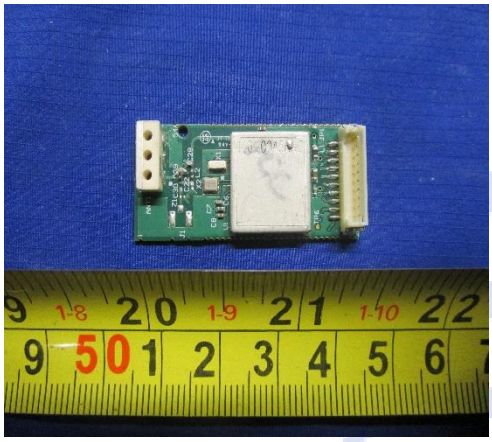
6.2. Radio description

Radio Type	ZIGBEE
Operating Frequency	2405MHz-2475MHz
Modulation	OPQSK
Channel Spacing	5MHz
Antenna Type	Chip Antenna
Antenna Gain	-1.0dBi
Antenna Connector Type	N/A

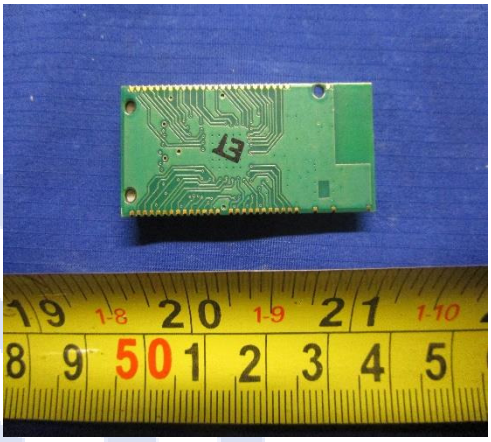
6.3. EUT Power level setting

Mode	Frequency (MHz)	Power setting
ZIGBEE	2405	High Power setting
ZIGBEE	2440	High Power setting
ZIGBEE	2475	High Power setting

6.4. EUT Photos

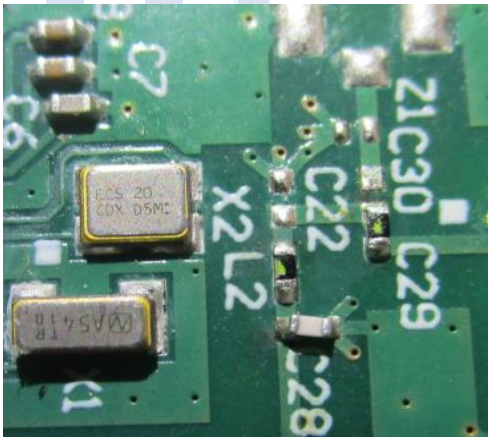


EUT Top View



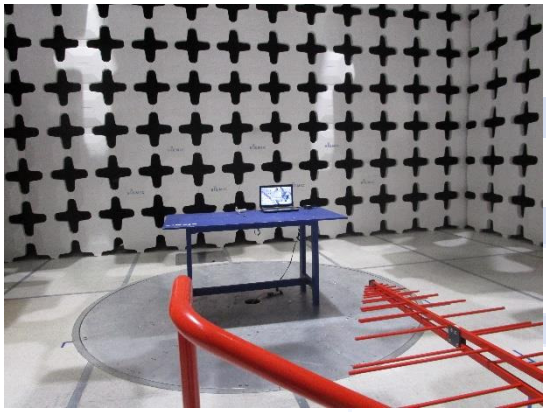
EUT Bottom View

EUT Cover Off View

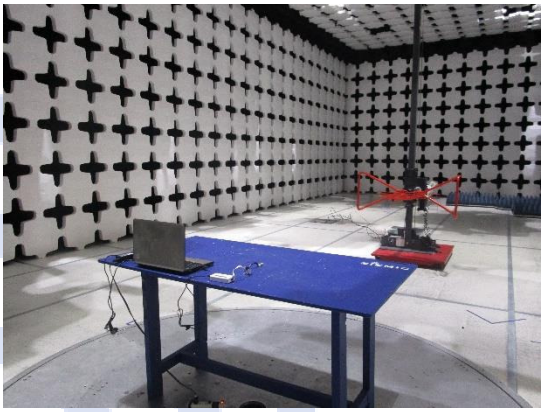


Crystal

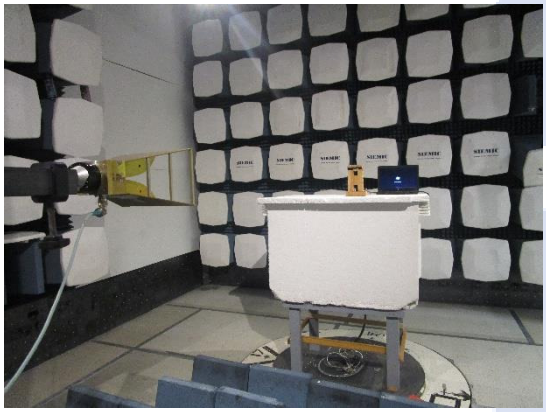
6.5. EUT Photos | Test setup



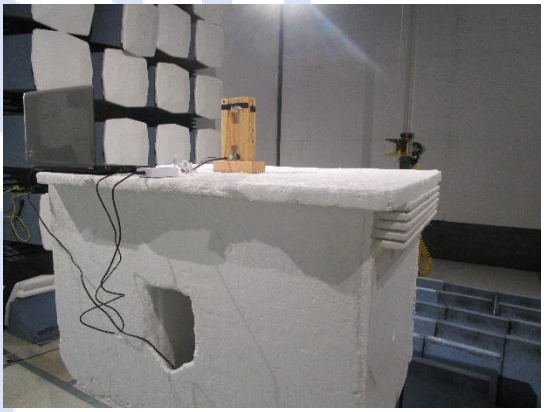
Radiated Emission Test setup (<1GHz) – Front View



Radiated Emission Test setup (<1GHz) – Rear View

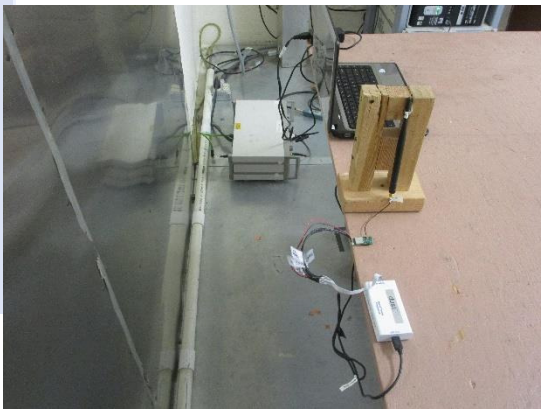


Radiated Emission Test setup (>1GHz) – Front View



Radiated Emission Test setup (>1GHz) – Rear View

AC Line Conducted Emissions – Front View



AC Line Conducted Emissions – Rear View

Note: The spurious emission in different EUT orientation was investigated, including the EUT standing up position and the laying down position. The EUT orientation shown in above setup photo is the worst case position.

7. Supporting equipment / Software / Cabling information

7.1. Support equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Notebook PC	G4-1215DX	00196-237-599-388	HP	-

7.2. Cabling description

Item	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
Power With Data Cable	EUT	Power /Data input	Fixture Box	Data Port	0.35 m	Unshielded	-
USB Cable	Fixture Box	Micro USB	Notebook Pc	USB Port	1.5 m	Shielding	

7.3. Test software description

Test Item	Software	Description
RF Testing	Putty	Set the EUT to transmit continuously in different test mode

8. Test summary

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Restricted Band of Operation	FCC	15.205	FCC	ANSI C63.10:2013	☒ Pass ☐ N/A
	IC	RSS Gen 8.10	IC	558074 D01 DTS Measure Guidance v03r04	
AC Conducted Emissions	FCC	15.207(a)	FCC	ANSI C63.10:2013	☒Pass ☐N/A
	IC	RSS Gen 8.8	IC	RSS Gen Issue 4: 2014	

DTS band Requirement

Test Item		Test standard		Test Method/Procedure	Pass / Fail
99% Occupied Bandwidth	IC	RSS Gen 6.6	IC	RSS Gen Issue 4: 2014	☒Pass ☐N/A
6dB Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 DTS Measure Guidance v03r04	☒ Pass ☐ N/A
	IC	RSS247 (5.2.1)	IC		
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC	ANSI C63.10:2013	☒ Pass ☐ N/A
	IC	RSS247 (5.5)	IC	558074 D01 DTS Measure Guidance v03r04	
Output Power	FCC	15.247(b)	FCC	558074 D01 DTS Measure Guidance v03r04	☒ Pass ☐ N/A
	IC	RSS247 (5.4.4)	IC		
Receiver Spurious Emissions	IC	RSS Gen (4.8)	IC	RSS Gen Issue 4: 2014	☐ Pass ☒ N/A
Antenna Gain < 6 dBi	FCC	15.247(e)	FCC	-	☐ Pass ☒ N/A
	IC	-	IC	-	
Power Spectral Density	FCC	15.247(e)	FCC	558074 D01 DTS Measure Guidance v03r04	☒ Pass ☐ N/A
	IC	RSS247 (5.2.2)	IC		
RF Exposure requirement	FCC	15.247(i)	FCC	-	☐ Pass ☒ N/A
	IC	RSS Gen(5.5)	IC	RSS Gen Issue 4: 2014	
Remark	1. All measurement uncertainties do not take into consideration for all presented test results. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.				

9. Measurement uncertainty

Emissions			
Test Item	**Frequency Range**	**Description**	**Uncertainty**
Band Edge and Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
Band Edge and Radiated Spurious Emissions	1GHz – 40GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+4.3dB/-4.1dB

10. Measurements, Examination and Derived results

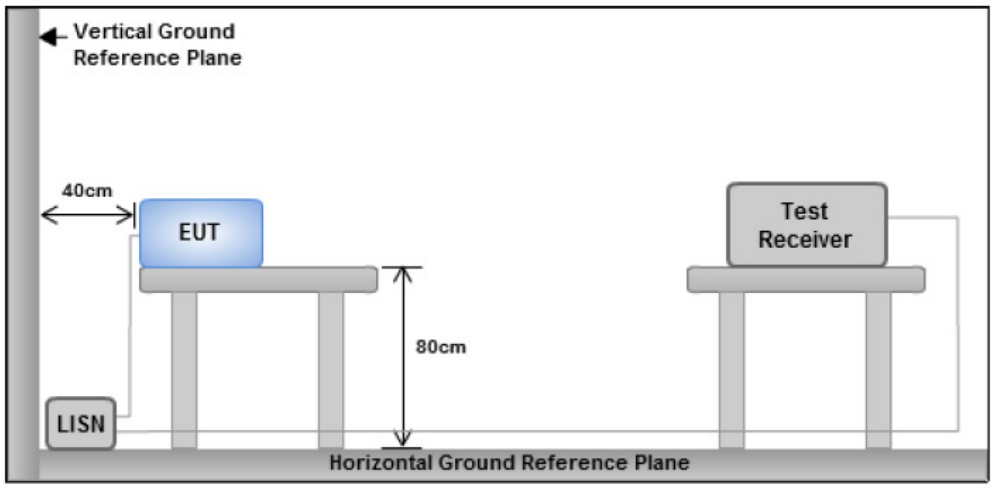
10.1. Conducted Emissions

Conducted Emission Limit

Frequency ranges (MHz)	Limit (dBuV)	
	QP	Average
0.15 ~ 0.5	66 – 56	56 – 46
0.5 ~ 5	56	46
5 ~ 30	60	50

Spec	Item	Requirement	Applicable
47CFR§15.207, RSS210(A8.1)	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	☒

Test Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

Procedure

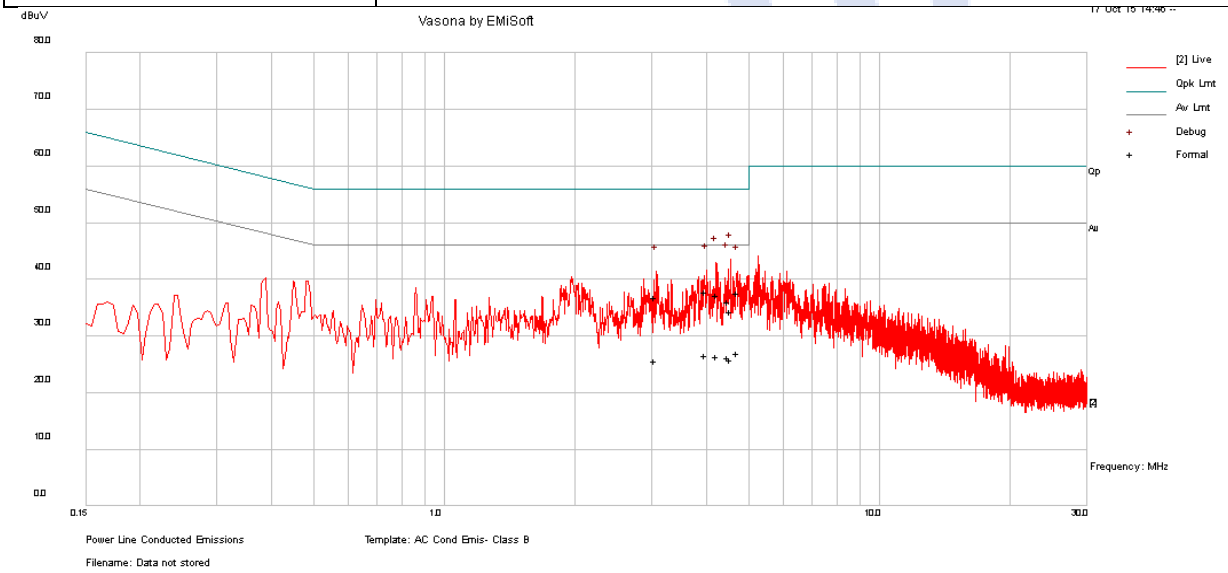
- The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.
- The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains.
- The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
- All other supporting equipment was powered separately from another main supply.

Remark: EUT tested with Handheld computer and Battery Pack.

Result: ☒Pass ☐ Fail

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Gary Chou			
Test Date:	12/03/2015			
Remarks	AC Line @ Line			

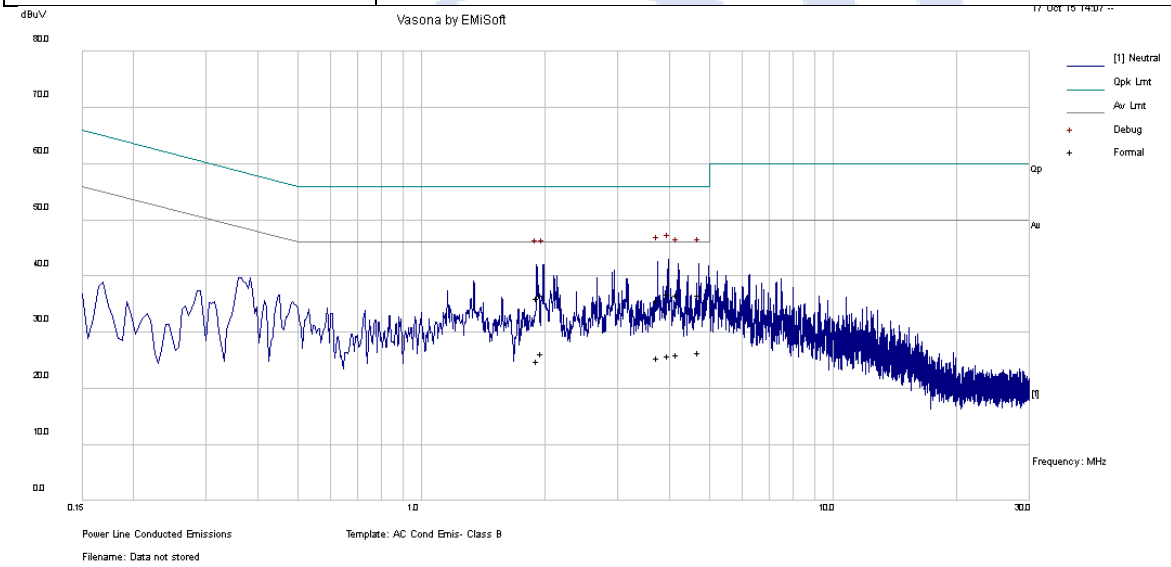


Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
4.56	23.72	10.04	0.55	34.31	Quasi Peak	Live	56	-21.69	Pass
4.23	26.59	10.03	0.55	37.18	Quasi Peak	Live	56	-18.82	Pass
4.50	25.49	10.03	0.55	36.08	Quasi Peak	Live	56	-19.93	Pass
3.99	27.25	10.03	0.55	37.84	Quasi Peak	Live	56	-18.17	Pass
4.71	27.05	10.04	0.55	37.63	Quasi Peak	Live	56	-18.37	Pass
3.06	26.3	10.03	0.55	36.88	Quasi Peak	Live	56	-19.12	Pass

4.56	15.3	10.04	0.55	25.89	Average	Live	46	-20.11	Pass
4.23	15.87	10.03	0.55	26.46	Average	Live	46	-19.54	Pass
4.50	15.61	10.03	0.55	26.2	Average	Live	46	-19.8	Pass
3.99	16.07	10.03	0.55	26.65	Average	Live	46	-19.35	Pass
4.71	16.5	10.04	0.55	27.09	Average	Live	46	-18.91	Pass
3.06	15.12	10.03	0.55	25.69	Average	Live	46	-20.31	Pass

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Gary			
Test Date:	12/03/2015			
Remarks	AC Line @ Neutral			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
3.98	26.31	10.03	0.55	36.89	Quasi Peak	Neutral	56	-19.11	Pass
3.74	25.18	10.03	0.55	35.76	Quasi Peak	Neutral	56	-20.24	Pass
4.19	26.06	10.03	0.55	36.65	Quasi Peak	Neutral	56	-19.35	Pass
4.72	26.01	10.04	0.55	36.6	Quasi Peak	Neutral	56	-19.4	Pass
1.96	26.09	10.02	0.55	36.66	Quasi Peak	Neutral	56	-19.34	Pass
1.92	25.48	10.02	0.55	36.05	Quasi Peak	Neutral	56	-19.95	Pass
3.98	15.26	10.03	0.55	25.85	Average	Neutral	46	-20.15	Pass

3.74	14.81	10.03	0.55	25.39	Average	Neutral	46	-20.61	Pass
4.19	15.49	10.03	0.55	26.08	Average	Neutral	46	-19.92	Pass
4.72	15.79	10.04	0.55	26.38	Average	Neutral	46	-19.62	Pass
1.96	15.66	10.02	0.55	26.23	Average	Neutral	46	-19.77	Pass
1.92	14.26	10.02	0.55	24.83	Average	Neutral	46	-21.17	Pass

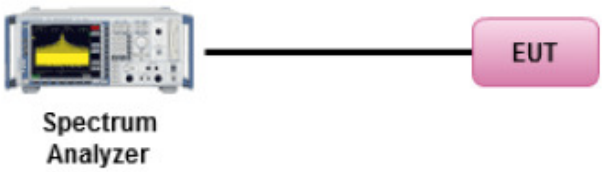
Note: The results above show only the worst case.

10.2. 6dB Bandwidth and 99% Occupied Bandwidth

Requirement(s):

Spec	Item	Requirement	Applicable
§FCC-15.247	a)(2)	6dB BW≥500KHz;	☒
§RSS-247	5.2(1)	6dB BW≥500KHz;	☒
§RSS-Gen	6.6	99% OBW For FCC reference only; Required by IC	☒

Test Setup



Test Procedure

558074 D01 DTS Meas Guidance v03r04, 8.1 DTS bandwidth

<u>6dB Emission bandwidth measurement procedure:</u>

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) ≥ 3 x RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

<u>99% Occupied bandwidth measurement procedure</u>

- Allow the trace to stabilize.
- Use the spectrum analyzer built-in measurement function to determine the 99% OBW.
  - Set RBW = close to 1% of the selected span as is
  - Set VBW = 3 x RBW
  - Detector = Peak
  - Trace mode = max hold
  - Sweep = auto couple
- Capture the plot.
- Repeat above steps for different test channel and other modulation type.

Test Date	12/03/2015	Environmental condition	Temperature:	25
			Relative Humidity:	40%
			Atmospheric	1010PA

Remark	N/A
Result	☒ Pass ☐ Fail

Equipment Setting

TEST	RBW	VBW	SPAN	Detector	SWEEP	Trace	NOTES
6 dB DTS Bandwidth	100KHz	3 x RBW	>EBW	PK	Auto	Max hold	-
99% OBW	1% of selected span	3 x RBW	>EBW	PK	Auto	Max hold	-

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

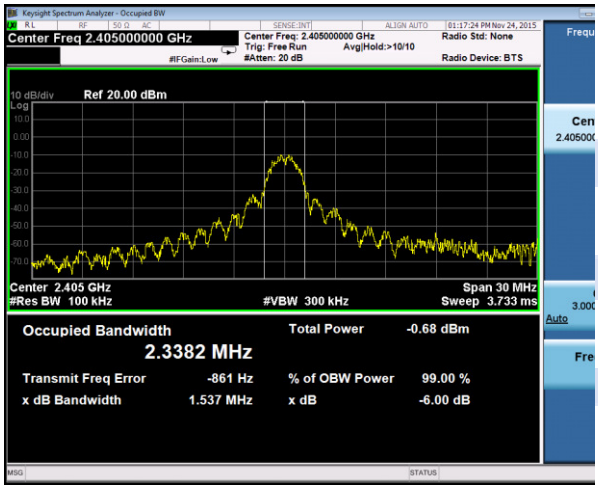
6dB Bandwidth measurement result

Type	Freq (MHz)	CH	Result (MHz)	Limit	Result
6dB BW	2405	Low	1.54	≥0.5	Pass
6dB BW	2440	Mid	1.30	≥0.5	Pass
6dB BW	2475	High	1.61	≥0.5	Pass

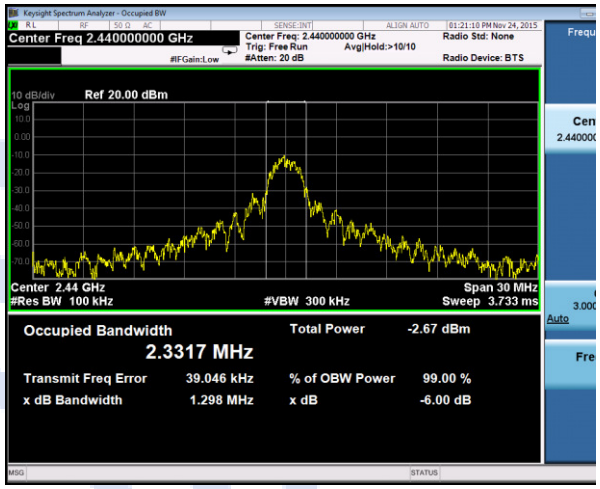
99% Occupied Bandwidth

Type	Freq (MHz)	CH	Result (MHz)
99% OBW	2405	Low	2.33
99% OBW	2440	Mid	2.33
99% OBW	2475	High	2.49

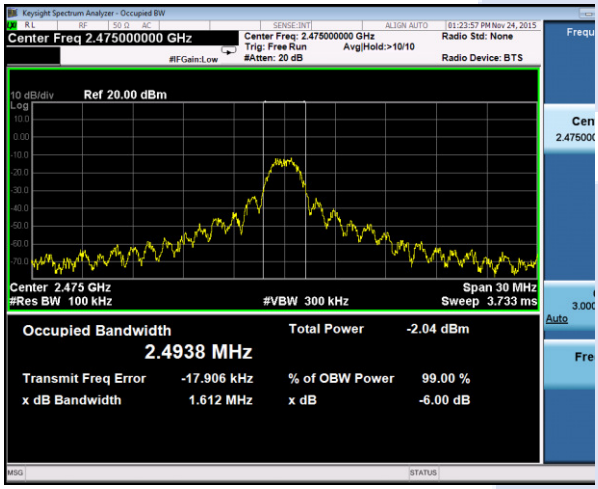
6dB Bandwidth AND 99% Occupied Bandwidth test plots



99% BW TX-Zigbee 2405



99% BW TX-Zigbee 2440

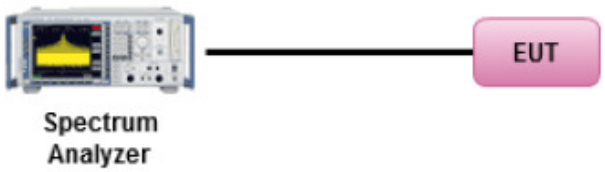


99% BW TX-Zigbee 2475

10.3. Output power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 § RSS-247	a)	FHSS in 2400-2483.5MHz with ≥ 75 channels: ≤1 Watt	☐
	b)	FHSS in 5725-5850MHz: ≤1 Watt	☐
	c)	For all other FHSS in the 2400-2483.5MHz band: ≤0.125 Watt.	☐
	d)	FHSS in 902-928MHz with ≥ 50 channels: ≤1 Watt	☐
	e)	FHSS in 902-928MHz with ≥ 25 & <50 channels: ≤0.25 Watt	☐
	f)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: ≤1 Watt	☒

Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v03r04, 9.1 Measurement using a Spectral Analyzer (SA) a) Set the RBW ≥ DTS bandwidth. b) Set VBW ≥ 3 × RBW. c) Set span ≥ 3 x RBW d) Sweep time = auto couple. e) Detector = peak. f) Trace mode = max hold. g) Allow trace to fully stabilize. h) Use peak marker function to determine the peak amplitude level.			
Test Date	12/02/2015	Environmental condition	Temperature:	25
			Relative Humidity:	40%
			Atmospheric	1010PA
Remark	N/A			
Result	☒ Pass ☐ Fail			

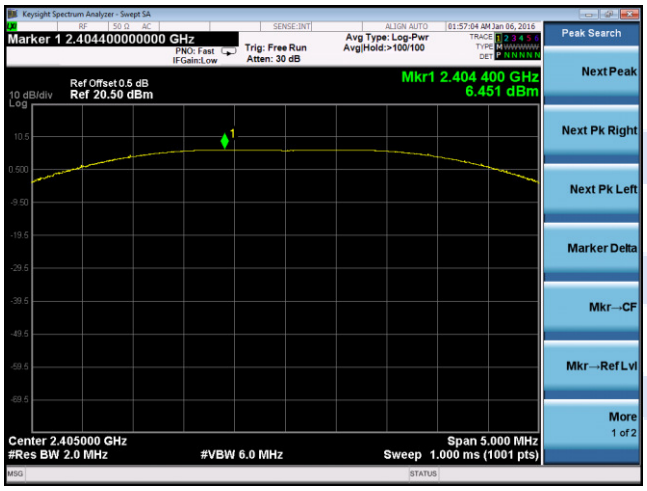
Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

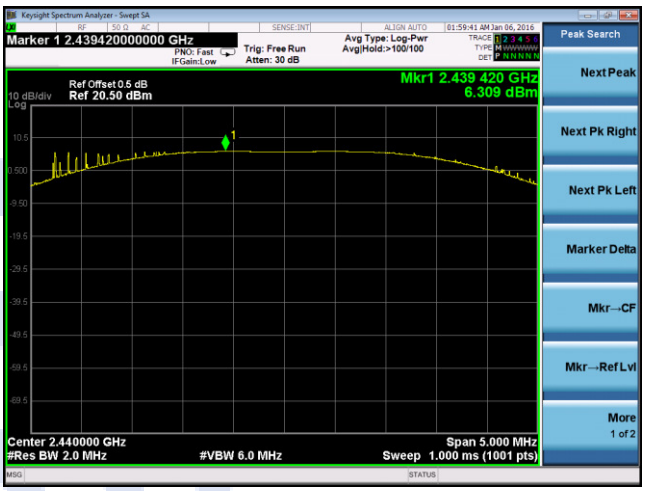
Output power measurement result

Test mode	Freq (MHz)	CH	Conducted Power	Limit (dBm)	Result
ZIGBEE	2405	Low	6.45	30	Pass
ZIGBEE	2440	Mid	6.30	30	Pass

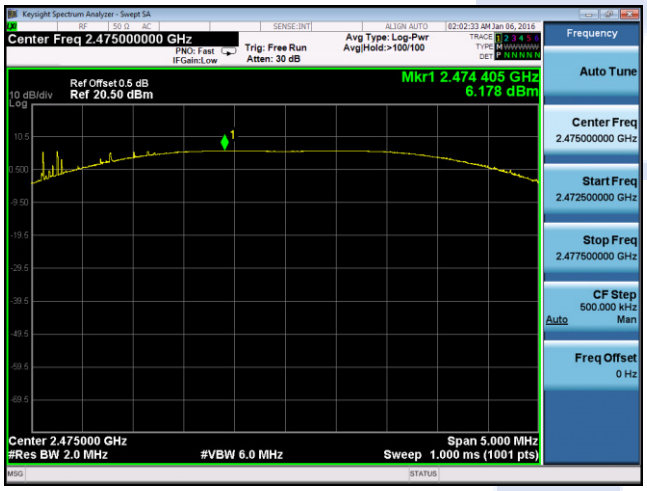
ZIGBEE	2475	High	6.17	30	Pass



PWR-Zigbee 2405



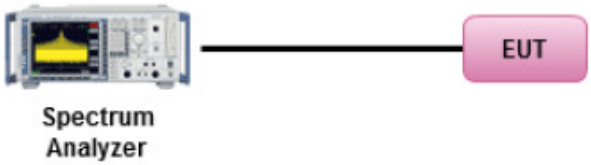
PWR -Zigbee 2440



PWR-Zigbee 2475

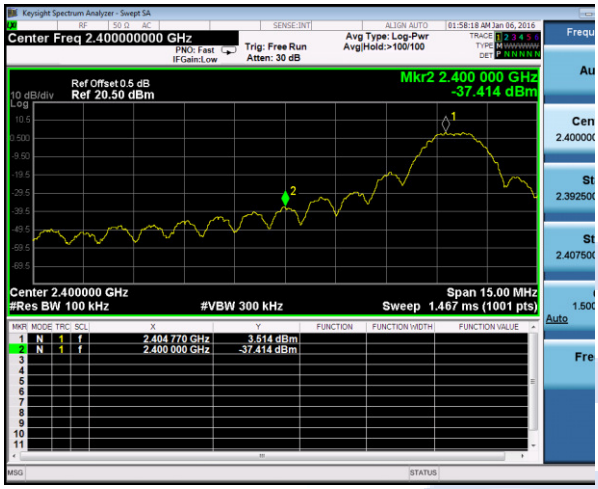
10.4. Band edge

Requirement(s):

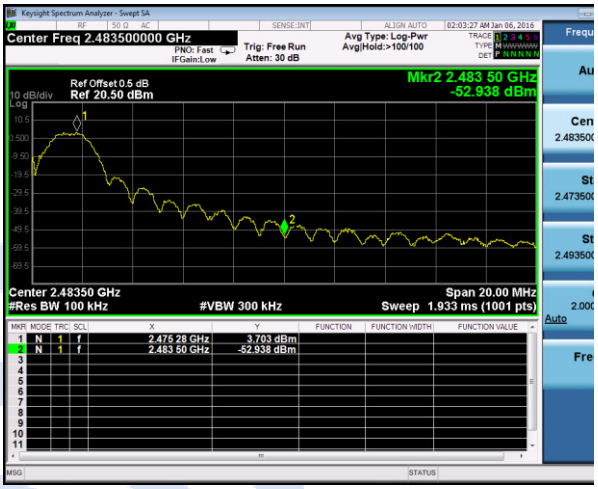
Spec	Item	Requirement	Applicable
§ 15.247 § RSS-247	d)	For non-restricted band, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209 (a) is not required ☐ 20 dB down ☒ 30 dB down	☒
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v03r04 <u>Band Edge measurement procedure</u> - Set the EUT to maximum power setting and enable the EUT transmit continuously. - Band edge emissions must be at least 30 dB down from the highest emission level within the authorized band as a measured. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used. - Change modulation and channel bandwidth then repeat step 1 to 2. - Measured and record the results in the test report.		
Test Date	01/06/2015	Environmental condition	Temperature: 25 Relative Humidity: 40% Atmospheric Pressure: 1010mba
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A



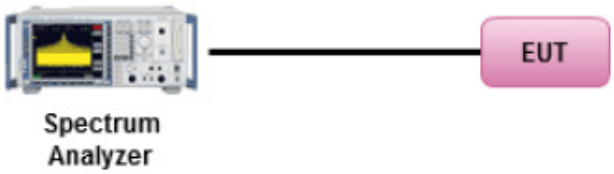
2405 MHz Band Edge



2475MHz Band Edge

10.5. Peak spectral density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247	e)	DSSS: ≤8dBm/3KHz	☒
§ RSS-247	f)	DSSS in hybrid sys with FH turned off: ≤8dBm/3KHz	☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v03r04, 10.2 Method PEAK PSD-1 <u>Peak spectral density measurement procedure</u> - a) Set analyzer center frequency to DTS channel center frequency. - b) Set the span to 1.5 times the DTS bandwidth. - c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz. - d) Set the VBW ≥ 3 x RBW. - e) Detector = peak. - f) Sweep time = auto couple. - g) Trace mode = max hold. - h) Allow trace to fully stabilize. - i) Use the peak marker function to determine the maximum amplitude level within the RBW. - j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.		
Test Date	12/02/2015	Environmental condition	Temperature: 25 Relative Humidity: 40 Atmospheric Pressure: 1010 Pa
Remark	N/A		
Result	☒ Pass ☐ Fail		

Equipment Setting

TEST	RBW	VBW	SPAN	Detector	SWEEP	Trace	NOTES
PSD	3KHz	≥3x RBW	1.5x DTS BW	PEAK	Auto	Trace POS Peak	-

Test Data ☒ Yes ☐ N/A

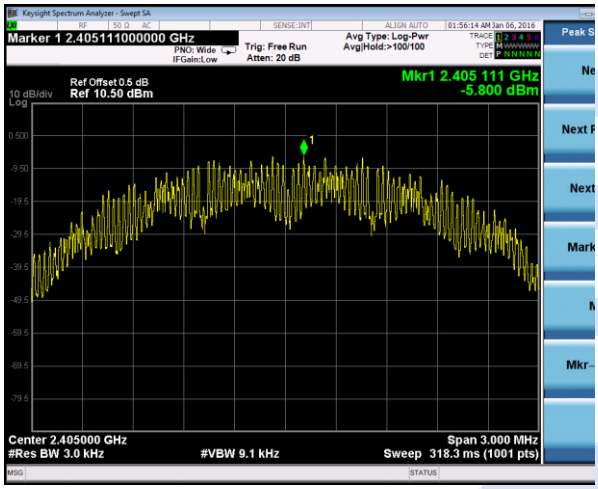
Test Plot ☒ Yes (See below) ☐ N/A

PSD measurement results

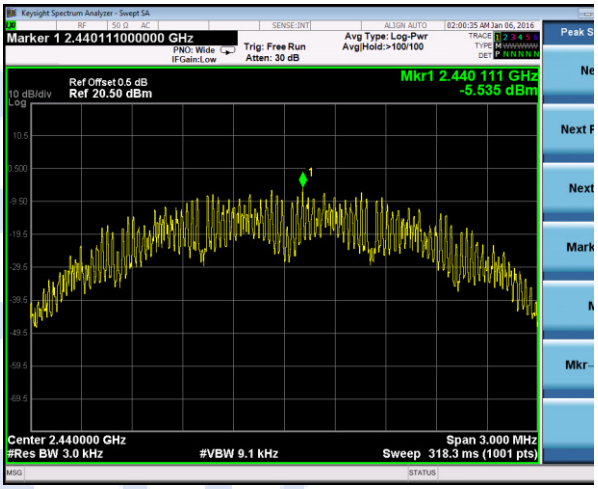
Test mode	Freq (MHz)	CH	Conducted Power (dBm/3KHz)	Limit (dBm/3KHz)	Result
ZIGBEE	2405	Low	-5.80	8	Pass
ZIGBEE	2440	Mid	-5.53	8	Pass
ZIGBEE	2475	High	-6.00	8	Pass

Test plots

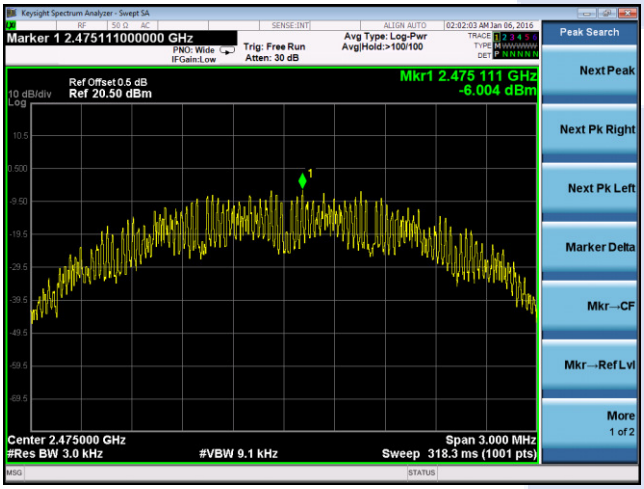
2405MHz PSD



2440MHz PSD



2475MHz PSD

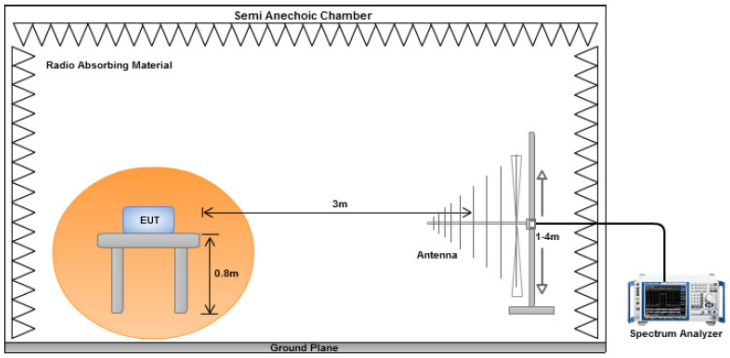


10.6. Radiated spurious emissions in restricted band

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), § RSS-247	a)	For non-restricted band, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required ☐ 20 dB down ☒ 30 dB down	☐
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	☒

Test Setup



Test Procedure

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. An average measurement was then made for that frequency point.
4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

Test Date	12/03/2015	Environmental condition	Temperature:	25
			Relative Humidity:	40
			Atmospheric Pressure:	1010 PA

Remark	The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. Radiated measurement was measured with antenna port terminated, there isn't outstanding emission found at the edge of restricted frequency, within x dB margin
Result	☒ Pass ☐ Fail

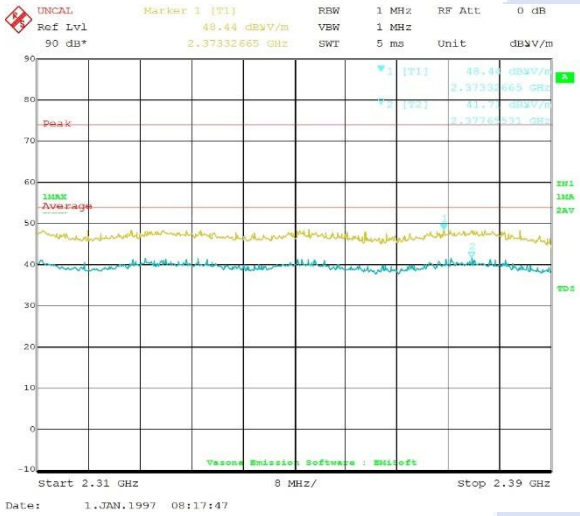
Equipment Setting

TEST	RBW	VBW	SPAN	Detector	SWEEP	Trace	NOTES
Radiated Spurious Emission	1MHz	3MHz	1GHz - 25 GHz	Peak	Auto	Max hold	PK Measurement
Radiated Spurious Emission	1MHz	10Hz	1GHz - 25 GHz	Peak	Auto	Max hold	Ave Measurement

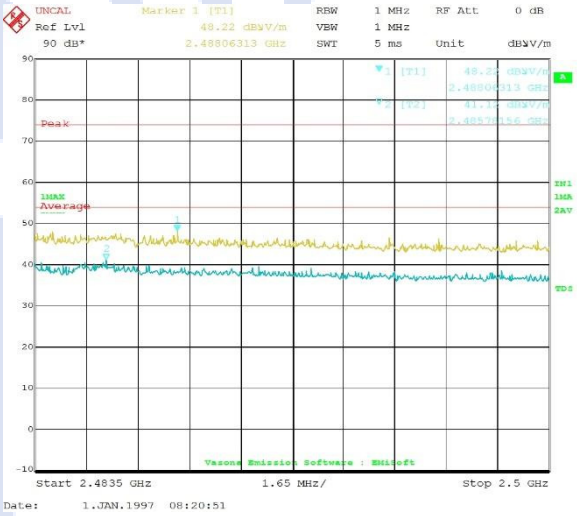
Test Data ☐ Yes ☒ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Restricted band measurement plots



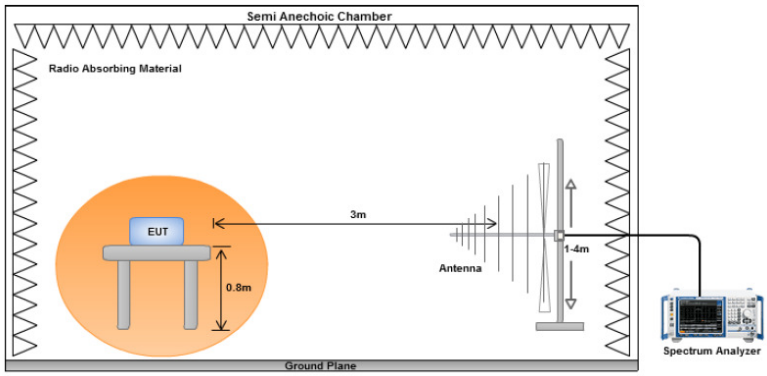
TX MODE 2405 MHz



TX MODE 2475 MHz

10.7. Radiated spurious emissions below 1GHz

Requirement(s):

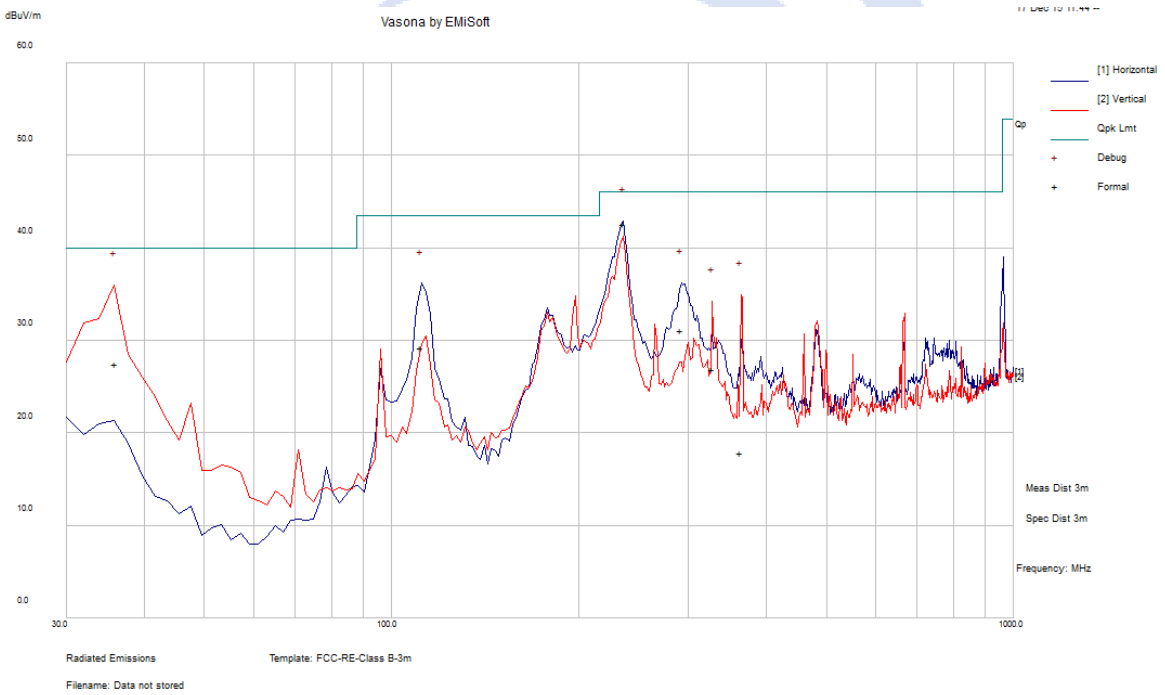
<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>47CFR§15.247(d)
§ RSS-247</td><td>a)</td><td>Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges
<table>
<tr><th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr>
<tr><td>30 – 88</td><td>100</td></tr>
<tr><td>88 – 216</td><td>150</td></tr>
<tr><td>216 960</td><td>200</td></tr>
<tr><td>Above 960</td><td>500</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="3"> 
</td></tr>
<tr><td>Procedure</td><td colspan="3">1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
b. The EUT was then rotated to the direction that gave the maximum emission.
c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. A Quasi-peak measurement was then made for that frequency point.
4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</td></tr>
<tr><td>Remark</td><td colspan="3">The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.</td></tr>
<tr><td>Result</td><td colspan="3">☒ Pass ☐ Fail</td></tr>
</table>

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Radiated emission test results (below 1GHz)

Test specification:	Radiated Emissions			
Environmental Conditions:	Temp(°C):	25	Result:	☒ Pass ☐ Fail
	Humidity (%):	58		
	Atmospheric(mbar):	1010		
Mains Power:	3.3V DC			
Tested by:	Gary Chou			
Test Date:	12/10/2015			
Remarks:	TX MODE 2440 MHz			

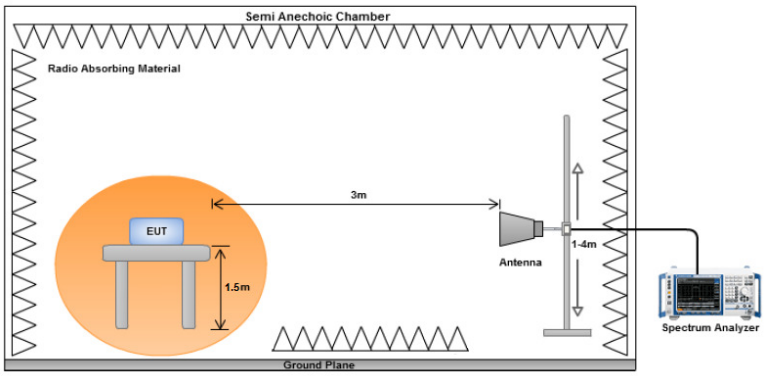


ZIGBEE

Frequency	Raw	Cable	AF (dB)	Level	Measurement	Pol	Hgt	Azt	Limit	Margin	Pass
235.86	66.98	2.63	-26.99	42.62	Quasi Max	H	147	174	46.02	-3.4	Pass
35.99	46.17	0.87	-19.59	27.45	Quasi Max	V	140	93	40	-12.55	Pass
111.66	53.03	1.74	-25.56	29.21	Quasi Max	H	357	256	43.52	-14.31	Pass
292.42	53.64	2.95	-25.52	31.07	Quasi Max	H	156	291	46.02	-14.95	Pass
364.34	38.06	3.38	-23.56	17.89	Quasi Max	V	101	100	46.02	-28.13	Pass
327.66	48.24	3.17	-24.46	26.95	Quasi Max	V	102	148	46.02	-19.07	Pass

10.8. Radiated spurious emissions between 1GHz-25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d) § RSS-247	a)	For non-restricted band, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required ☐ 20 dB down ☒ 30 dB down	☒
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	☒
Test Setup			
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. A Quasi-peak measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.		
Remark	The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.		
Result	☒ Pass ☐ Fail		

Test Data	☒ Yes	☐ N/A
Test Plot	☒ Yes (See below)	☐ N/A

Radiated emission test results (above 1GHz)

Above 1GHz-25GHz- ZIGBEE 2405MHz

Frequency	Raw	Cable	AF (dB)	Level	Measurement	Pol	Hgt	Azt	Limit	Margin	Pass
4144.02	33.5	8.86	11.6	53.96	Peak Max	H	201	347	74	-20.04	Pass
3802.35	34.98	7.42	11.5	53.9	Peak Max	V	201	53	74	-20.1	Pass
4144.02	21.68	8.86	11.6	42.14	Average Max	H	201	347	54	-11.86	Pass
3802.35	23.35	7.42	11.5	42.28	Average Max	V	201	53	54	-11.72	Pass

Above 1GHz-25GHz- ZIGBEE 2440MHz

Frequency	Raw	Cable	AF (dB)	Level	Measurement	Pol	Hgt	Azt	Limit	Margin	Pass
4858.07	33.21	10.44	9.66	53.31	Peak Max	V	221	127	74	-20.69	Pass
3902.43	34.63	7.97	11.88	54.48	Peak Max	V	228	228	74	-19.52	Pass
4858.07	22.07	10.44	9.66	42.16	Average Max	V	221	127	54	-11.84	Pass
3902.43	22.8	7.97	11.88	42.65	Average Max	V	228	228	54	-11.35	Pass

Above 1GHz-25GHz- ZIGBEE 2475MHz

Frequency	Raw	Cable	AF (dB)	Level	Measurement	Pol	Hgt	Azt	Limit	Margin	Pass
6154.21	32.7	10.67	10.7	54.07	Peak Max	H	143	343	74	-19.93	Pass
3890.49	35.01	7.91	11.83	54.75	Peak Max	V	243	182	74	-19.25	Pass
6154.21	21.02	10.67	10.7	42.39	Average Max	H	143	343	54	-11.61	Pass
3890.49	22.98	7.91	11.83	42.72	Average Max	V	243	182	54	-11.28	Pass

11. Annex A | Test Instruments

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
R & S Receiver	ESIB 40	100179	05/23/2015	1 Year	05/23/2016	☑
CHASE LISN	MN2050B	1018	08/07/2015	1 Year	08/07/2016	☑
Radiated Emissions						
R & S Receiver	ESL6	100178	05/27/2015	1 Year	05/27/2016	☐
R & S Receiver	ESIB 40	100179	05/23/2015	1 Year	05/23/2016	☑
ETS-Lingren Loop Antenna	6512	00049120	05/12/2015	1 Year	05/12/2016	☐
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/12/2015	1 Year	08/12/2016	☑
Horn Antenna (1-26.5GHz)	3115	10SL0059	04/26/2015	1 Year	04/26/2016	☑
Pre-Amplifier	LPA-6-30	11140711	02/19/2015	1 Year	02/19/2016	☑
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	05/30/2015	1 Year	05/30/2016	☑
3 Meters SAC	3M	N/A	08/08/2015	1 Year	08/08/2016	☑
10 Meters SAC	10M	N/A	09/05/2015	1 Year	09/05/2016	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	10SL0219	08/20/2015	1 Year	08/20/2016	☑
R & S Receiver	ESIB 40	100179	05/23/2015	1 Year	05/23/2016	☑
Test Equity Environment Chamber	1007H	61201	07/31/2015	1 Year	07/31/2016	☐
USB RF Power Sensor	7002-006	10SL0190	09/03/2015	1 Year	09/03/2016	☐

12. Annex B | SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII
Japan Recognized Certification Body Designation		**Radio**: A1. Terminal equipment for purpose of calling **Telecom**: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI **EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EM, KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS

		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radio communications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06, AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2